

REMARKS / ARGUMENTS

In complete response to the Final Office Action dated April 4, 2011, on the above identified application, reconsideration is respectfully requested.

With this amendment, claim 36 is amended to correct an antecedent basis issue and claims 44-49 are canceled. Claims 36-43 remain pending in this application.

First Claim Rejection under 35 U.S.C. § 103

Claims 44 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buchanan et al. (US 2003/0203653) ("Buchanan").

These rejections are moot in view of the cancelation of the claims.

Second Claim Rejection under 35 U.S.C. § 103

Claims 36, 38-42, and 46-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (US 2001/0048973) ("Sato") in view of Buchanan. Applicants respectfully disagree.

By the amendments submitted herewith, claims 44-49 have been cancelled. Independent claim 36 requires a separate synthesis reaction of trisilylamine and a hydrazine. Applicants respectfully submit that Buchanan, Sato, or their combination would not motivate one of ordinary skill in the art to perform a separate synthesis reaction of trisilylamine and a hydrazine.

Sato discloses three CVD processes: First and Third Chemical Vapor Deposition Processes, which do not require the use of the preliminary reaction chamber, and a Second Chemical Vapor Deposition Process, which does require the use of the preliminary reaction chamber. Sato expressly suggests using the preliminary reaction chamber the Second Chemical Vapor Deposition Process for cases where a solid will form as an undesirable reaction product.

Second Chemical Vapor Deposition Process

[0045] The second chemical vapor deposition process of the present invention is to form a silicon nitride film on a substrate by carrying out a preliminary reaction between the above feed gases, and feeding the resulting reaction gas mixture from which the solid compounds such as ammonium halide produced by the preliminary reaction has been eliminated.

[0049] In the second chemical vapor deposition process of the present invention, the solid compounds such as ammonium halide is intentionally allowed to separate out during this preliminary reaction, and the resulting reaction gas mixture from which the solid compound such as ammonium halide has been eliminated is fed to the chemical vapor deposition growth reaction. Any means can be employed in order to eliminate the ammonium halide precipitated. For

Buchanan discloses at para 0032 that a reaction between the Si-N containing molecule and the nitridizing species may be conducted during deposition or as a post processing step:

[0032] The present invention novel nitrogen-rich layer 44 can be deposited by a novel method of surface pyrolysis of molecules that contain at least Si and N atoms, but do not contain carbon atoms. Optionally, the nitrogen-rich layer 44 can be altered by reacting it with oxidizing or nitridizing species such as NH_3 , N_2H_4 , O_2 , N_2O , NO , etc. The reaction can be conducted either during the deposition with the Si-N containing molecules or can be carried out as a post processing step.

As Buchanan discloses that the reaction can be conducted during the deposition, one of ordinary skill in the art would not add an additional processing step where one is not needed. For this reason alone, the present rejection should be withdrawn.

Additionally, the purpose of the oxidizing or nitridizing species in Buchanan is to add oxygen or nitrogen to the nitrogen-rich layer 44, not to form a precursor gas comprising a silylhydrazine. Thus, the disclosure in para 0032 that the nitridizing

species may be conducted *during deposition or post processing*. Buchanan discloses at para 0035 that the TSA molecule enables a lower temperature route to the formation of a silicon and nitrogen containing layer via low pressure chemical vapor deposition *than any other precursor known* (emphasis added). Therefore, based upon these disclosures, Buchanan provides no motivation to react TSA with the nitridizing agent outside of the reactor *prior to deposition* in order to form a TSA derivative compound because one of ordinary skill in the art would expect the resulting compound to require higher temperature deposition conditions. For this reason alone, the present rejection should be withdrawn.

Sato reinforces Buchanan's disclosure at para 0063:

[0063] The product gas of the preliminary reaction between SiH_2Cl_2 and NH_3 can contain a highly reactive gas. Such a highly reactive gas can make the coverage worse. When this highly reactive gas is allowed to pass through a reaction pipe at a temperature almost equal to the thin film deposition temperature, the gas immediately produces deposits on the reaction pipe, and is thus consumed. On the other hand, a gas with low reactivity hardly produces deposits even when it is allowed to pass through a reaction pipe at a temperature near the reaction temperature. Therefore, by making the temperature of the preliminary reaction pipe almost equal to the thin film deposition temperature so that a highly reactive gas can be consumed during the period of residence time, a film excellent in coverage can be obtained. Specifically, by allowing the product gas of the preliminary reaction to pass through the preliminary reaction pipe whose temperature had been adjusted to almost equal to the thin film deposition temperature by the use of an electric furnace 7 as shown in FIG. 8, a film excellent in coverage was able to be obtained by feeding a gas having low reactivity to the reaction chamber.

In other words, the highly reactive gas produced from the reaction of the silane compound and the hydrazine compound is deposited on the reaction pipe. In contrast to the highly reactive TSA of Buchanan that permits low temperature, low pressure CVD, the reaction product of Sato has low reactivity. For this reason alone,

the combination of Buchanan and Sato would not motivate one of ordinary skill in the art to react TSA with hydrazine prior to deposition.

Applicants respectfully submit that independent claim 36 is allowable over the combination of Buchanan and Sato because one of ordinary skill in the art would not combine Buchanan and Sato in the manner suggested in the Office Action.

Claims 38-42 are dependent upon claim 36. As discussed above, the combination of Buchanan and Sato does not render obvious claim 36. Since claims 38-42 introduces additional subject matter to claim 36, Applicants submit that the recitations of claims 38-42 are not rendered obvious by the combination of Buchanan and Sato and respectfully request that claims 38-42 be passed to allowance.

Third Claim Rejection under 35 U.S.C. § 103

Claims 37, 43, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato in view of Buchanan as applied above and further in view of Wang et al. (US 2004/0194706) ("Wang").

This rejection is derivative of the preceding obviousness rejection and should be withdrawn at least for the same reasons stated above.

CONCLUSION

Accordingly, it is believed that the present application now stands in condition for allowance. Early notice to this effect is earnestly solicited. Should the Examiner believe a telephone call would expedite the prosecution of the application, he is invited to call the undersigned attorney at the number listed below.

Respectfully submitted,

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